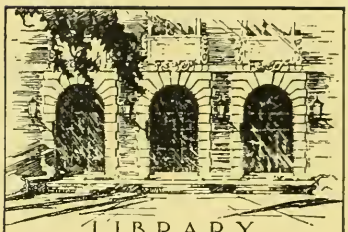

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WINDBREAKS for ILLINOIS FARMSTEADS

J. E. DAVIS
EXTENSION FORESTER
ILLINOIS NATURAL HISTORY SURVEY

CIRCULAR 29

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WINDBREAKS
for
Illinois Farmsteads

J. E. DAVIS
Extension Forester

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Theodore H. Frison, Chief

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CONTENTS

Introduction

Need 1
Benefits 1

Planning the Windbreak

Species of Trees to Use 2
Size and Sources of Planting Stock 3
Locating the Windbreak 4
Distances from Buildings 5
Number of Rows and Spacing 6

Planting the Windbreak

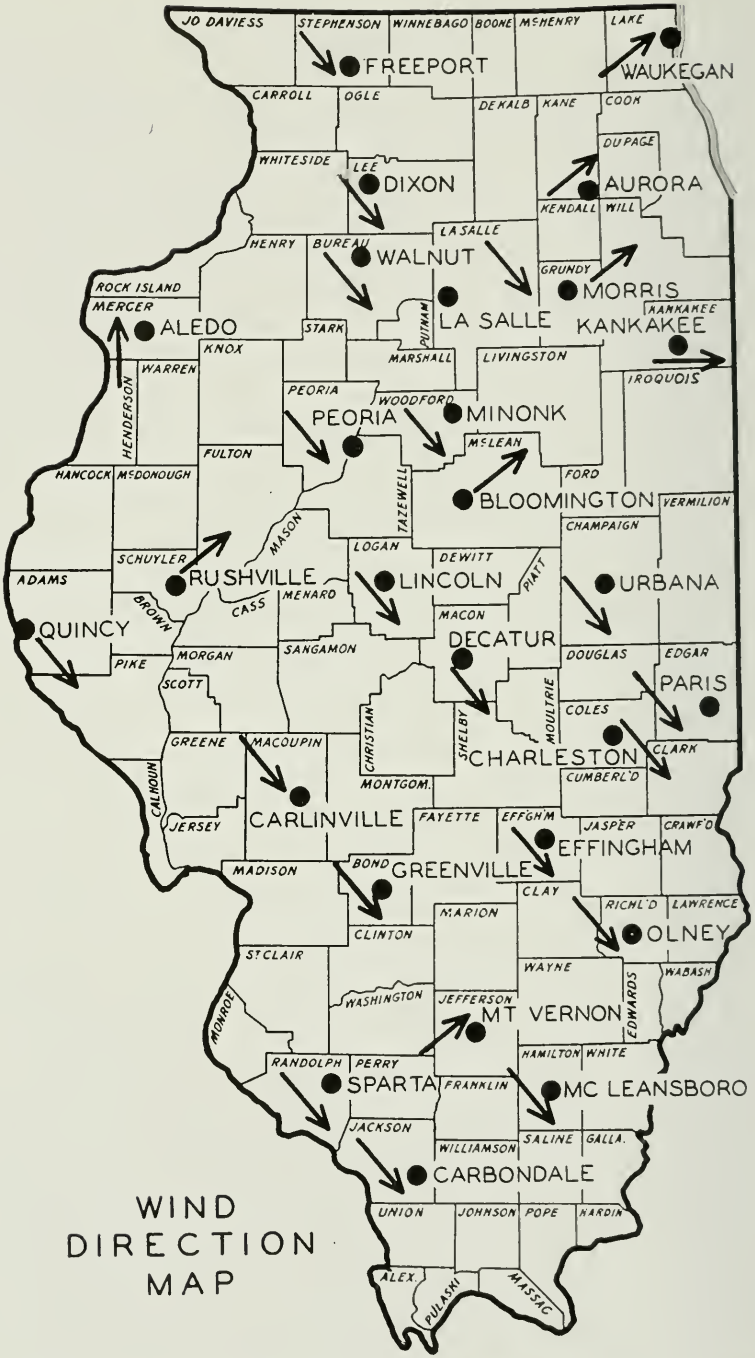
Preparation for Planting 7
Handling the Trees 7
Planting 11

Care of the Windbreak

Protection 12
Cultivation 12
Mulching 12
Replanting 13
Renewing Old Windbreaks 13
Diseases and Insects 14
Expectations 15

What the Windbreak Trees Are Like

Norway Spruce 16
Douglas Fir 16
Black Hills Spruce 16
Norway Pine (Red Pine) 17
White Pine 17
Shortleaf Pine 17
Pitch Pine 18
Red Cedar 18



The arrows show the direction of the average prevailing wind during winter months of a 10-year period, 1926-35, for 27 cities of Illinois.

WINDBREAKS
For Illinois Farmsteads

J. E. DAVIS
Extension Forester*

WINDBREAK, as commonly understood in Illinois, is the name given to a narrow belt of trees planted around a farmstead to provide protection from the wind.

Need.—With almost constant northwest winds blowing throughout the winter months (see map on opposite page) and with only one-fifth of the original protective forest growth remaining, there is serious need for protecting farmsteads from winds in Illinois. This is particularly true in the sections of intensive agriculture, where differences in elevation are not sufficient to break the force of the wind and where most of the tree growth has been cleared to make way for annual crops. From 1870 to 1875 considerable interest in windbreak planting was evidenced in the northern part of the state, and those early plantings which were given good care and protection now stand as landmarks, the better evergreen windbreaks having reached heights of 60 feet.

The trees used in early windbreaks were mostly of European origin, and it was not always easy to obtain good planting stock. Today, with both state and private tree nurseries producing large quantities of the trees best suited for windbreak planting, more farmsteads could be easily provided with wind protection at very little cost.

Benefits.—The greatest benefit that can be expected from a good windbreak is the sheltering effect on the farmhouse, the farm buildings and the feed lots. A house protected by a windbreak is more comfortable in winter, and less costly to heat. On wash days, clothes can be hung in the protection of the windbreak, without discomfort, when the biting winter winds are howling down out of the north. Windbreak-protected barns and feed sheds are warmer in winter and keep more nearly even temperatures, so that livestock can be more easily carried over winter in good condition. Livestock can also make more winter use of protected feedlots; and for men working around feedlots

*State Natural History Survey and University of Illinois College of Agriculture, cooperating.

and barns the windbreak provides comfort in the zone of quiet air to the leeward of its spreading branches.

With its contribution of beauty and color, as well as comfort, the windbreak can make a farm home out of a farmhouse.

Fig. 1.—Farmstead in southeastern Henry County, facing south. Upper: Note protective strips of trees on north and west. Lower: Feed shed and feed lots of this farmstead are well protected by a 28-year-old windbreak of Norway spruce.

Where the farmstead is protected by a windbreak, flowers, shrubs and ornamental trees have a better chance to develop, and beautification of the home grounds is more easily achieved. Windbreaks catch winter snows, and prevent their blocking walks and drives, and piling up around buildings. This snow melts slowly in the spring under the shade of the trees and the moisture is conserved for garden crops and small fruits planted near the windbreak.

PLANNING THE WINDBREAK

Species of Trees to Use.—Evergreen trees provide the most satisfactory windbreak because they hold their foliage during the winter months when protection is most needed. The spruce and fir form an almost solid barrier to the wind because of their

dense-branching habit and their tendency to hold heavy foliage on branches close to the ground, if given plenty of growing room. Of this group the Norway spruce, the Douglas fir and the Black Hills spruce are best adapted to Illinois conditions.

Pines make more rapid height growth than spruce or fir, but their branching habit is more open and their foliage thinner, so that they do not break the wind so completely. To attain

Fig. 2.—This farmstead in Jo Daviess County enjoys the protection of a 60-year old Norway spruce windbreak.

height in a windbreak at an earlier date, pine may be used as a center row between two outer rows of spruce or fir. Pine should not be used alone, except on light sandy soils to which the other trees are not adapted. Four pines—Norway pine, white pine, shortleaf pine and pitch pine—may be used for windbreaks. The shortleaf pine is a southern tree, native to lower Illinois, and should be used only in the southern third of the state. The other three may be used throughout Illinois.

Another evergreen, the red cedar, is occasionally used for windbreaks. It is rather short and comparatively slow growing, but it has very dense foliage and is pleasing in appearance.

Size and Sources of Planting Stock.—Quicker results and greater success can be expected from using fairly large planting stock. Transplant trees at least four years old should be used. These will vary from 12 to 20 inches in height of top and are usually designated as 2-2 transplants, having been grown two years in the seed bed and two years in transplant rows. Windbreaks generally require 150 to 250 trees, varying, of course, with the length necessary to protect buildings and lots. (See "Number of Rows and Spacing," page 6.) In purchasing

trees it is advisable to get at least 10 more than are actually needed, so that some extra trees may be kept in the garden and used to replace losses in the windbreak planting.

The majority of ornamental nurseries grow the types of trees satisfactory for windbreaks, and some of the larger nurseries specialize in producing windbreak trees. Pines may be obtained from the State Department of Conservation at Springfield, Illinois, and spruce will probably be available by 1940. Information on sources and prices of windbreak planting stock may be had by writing to the Extension Forester, 213 New Agriculture Building, University of Illinois, Urbana, Illinois.

Trees should be ordered early in the winter to assure getting the desired trees before supplies run out.

Locating the Windbreak.—By the map facing page 1 it will be seen that for nearly all of Illinois the prevailing winter wind is from the northwest, and the windbreak, to give the best protection, should be located to the north and west of the farmstead. Even in those few localities where the prevailing wind is southerly it is not advisable to place a windbreak to the south of the farmstead, for even in these localities the coldest winds are from the north and northwest. It must be remembered, also, that the prevailing summer winds are southwest, and it is desirous to have the farmstead exposed to the south to receive the cooling effects of these winds. In localities where the prevailing wind is south or southwest it is advisable to run the north-south line of the windbreak at least 100 feet farther than usual to the south of the farm buildings but the windbreak should never be planted on the south side of the farmstead.

The most effective and most easily arranged windbreak is in the form of an inverted L with the point to the northwest. The legs of the L may be broken to make way for farm lanes, but it should not be broken near the corner, where northwest winds may sweep through directly to the buildings.

Figures 5 and 6 show windbreak plans for farmsteads facing the cardinal points of the compass. These plans are for typical farmsteads found in Illinois, but are set up only as guides for the prospective windbreak planter. Because of the unlimited ways in which farm buildings are arranged, nearly every farmstead presents a different problem in the planning of the windbreak. If the principles recommended herein are followed in planning the windbreak it should be possible to provide satisfactory protection for any type of farmstead arrangement.

Farmsteads facing south or east, fig. 5, are the easiest for which to plan windbreaks. Those facing north or west, fig. 6, present more difficult problems, because of the necessity for completely shutting out the front outlook from the house, if the best protection is to be had. Most Illinois farm homes are

Fig. 3.—A well-spaced windbreak in McLean county. Trees are Norway spruce eight years old.

built so close to the road that there is not room enough to plant a good solid windbreak across the front of the house to check west or north winds. Usually it is necessary to sacrifice both part of the efficiency of the windbreak and part of the outlook and make the short leg of the L only a single row of trees extending whatever distance is desired across the front of the property.

Where farmsteads face north or west, and it is not desired to obstruct the view at all from the front of the house, the windbreak can then take only the form of a straight line running along the west or north side of the farmstead.

Distances from Buildings.—Effective protection is afforded by a good windbreak to a distance approximately eight times its height. Thus a windbreak 40 feet high should almost completely check the wind for 320 feet to leeward, and buildings and lots in this area should have adequate protection. Some in-

fluence of the windbreak may be felt at a distance up to 20 times the height of the trees, but in this state it is best to keep principal buildings within the 300-foot area.

To avoid dead-air pockets around buildings in summer, or piling of snow on buildings and walks in winter, the windbreak should not be set within 50 feet of buildings, and 100 feet is better if room is available. Where possible the end of the windbreak should extend at least 50 feet past the line of the last building to be protected. In localities where the prevailing wind is southwest, the south end of the windbreak should be extended at least 100 feet farther than usual.

Number of Rows and Spacing.—For the species of evergreens previously mentioned, the best type of windbreak consists of three rows of trees, with the trees in the middle row alternated with those in the two outside rows, fig. 4. The rows should be at least 12 feet apart and the trees should be spaced 14 feet apart in the rows. With this spacing, when three rows are used three trees are required for every 14 feet of windbreak; the planting rate is one tree per 4.6 feet. Thus a 600-foot windbreak will require 150 trees. *Do not be tempted to plant trees close together to form a hedge*, for evergreens need plenty of room and light to develop dense lower branches, and the lower branches are needed to check surface winds when the trees start making good height growth.

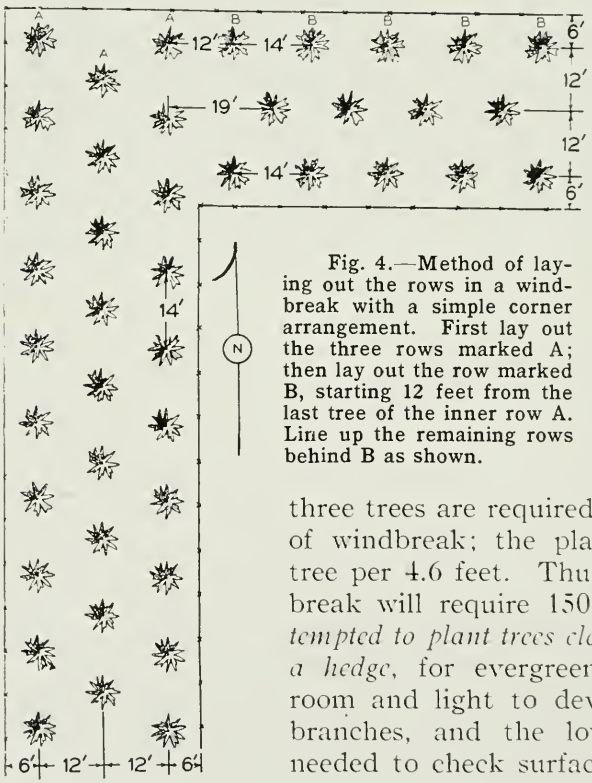


Fig. 4.—Method of laying out the rows in a windbreak with a simple corner arrangement. First lay out the three rows marked A; then lay out the row marked B, starting 12 feet from the last tree of the inner row A. Line up the remaining rows behind B as shown.

To avoid difficulties in laying out the corner of the windbreak follow the plan shown in fig. 4. First stake out one strip

of the windbreak *for its entire length*, *A*. Then lay out the outer row of the second strip, *B*, in line with the two last trees in the outside rows of the first strip and at right angles to the rows. Stake out this row beginning 12 feet from the last tree in the inside row of the first strip. The middle row of the second strip will then start 19 feet from the inside row of the first strip in order to keep the proper alternate spacing.

PLANTING THE WINDBREAK

Preparation for Planting.—All plans for the windbreak should be made in the fall, and the area should be marked out, including a strip at least 6 feet wide outside of the outer rows which will come between the fence and the trees. It is essential to plow the windbreak area thoroughly in the fall and to follow by disking and then by harrowing in the spring.

Since windbreaks are located to protect barns and lots as well as houses, there may often be a drainage of barnyard water across the windbreak area. Such drainage will kill out evergreens in a short time and should be taken care of before the trees are planted. The barnyard water may be carried around the windbreak by a diversion ditch, or through it by a ditch or tile. Diversion is better wherever possible.

It will be more convenient, and surer, to build necessary fences around the windbreak area in the fall so that the fencing will not be neglected later because of the rush of spring work. Fencing must be adequate to keep out both stock and poultry, and should be at least 6 feet from the rows of trees, fig. 4.

Only spring planting of windbreaks is recommended, so that the trees may have the advantage of one growing season and be in better position to survive the rigors of their first winter. Fall-planted windbreaks may suffer heavy losses from frost heaving, and one cannot afford to lose a large number of trees of the size used for windbreak planting.

After the planting area has been well harrowed in the spring, each row should be laid out, and the place for each tree marked with a stake. Lath makes handy markers for this use. It is important that the area be ready so that planting may be done without delay as soon as the trees are received.

Handling the Trees.—Nurseries will ship trees at your request, and when your order is confirmed you should notify the nursery of a shipping date which will bring you the trees at a time when in your experience you know the ground will be

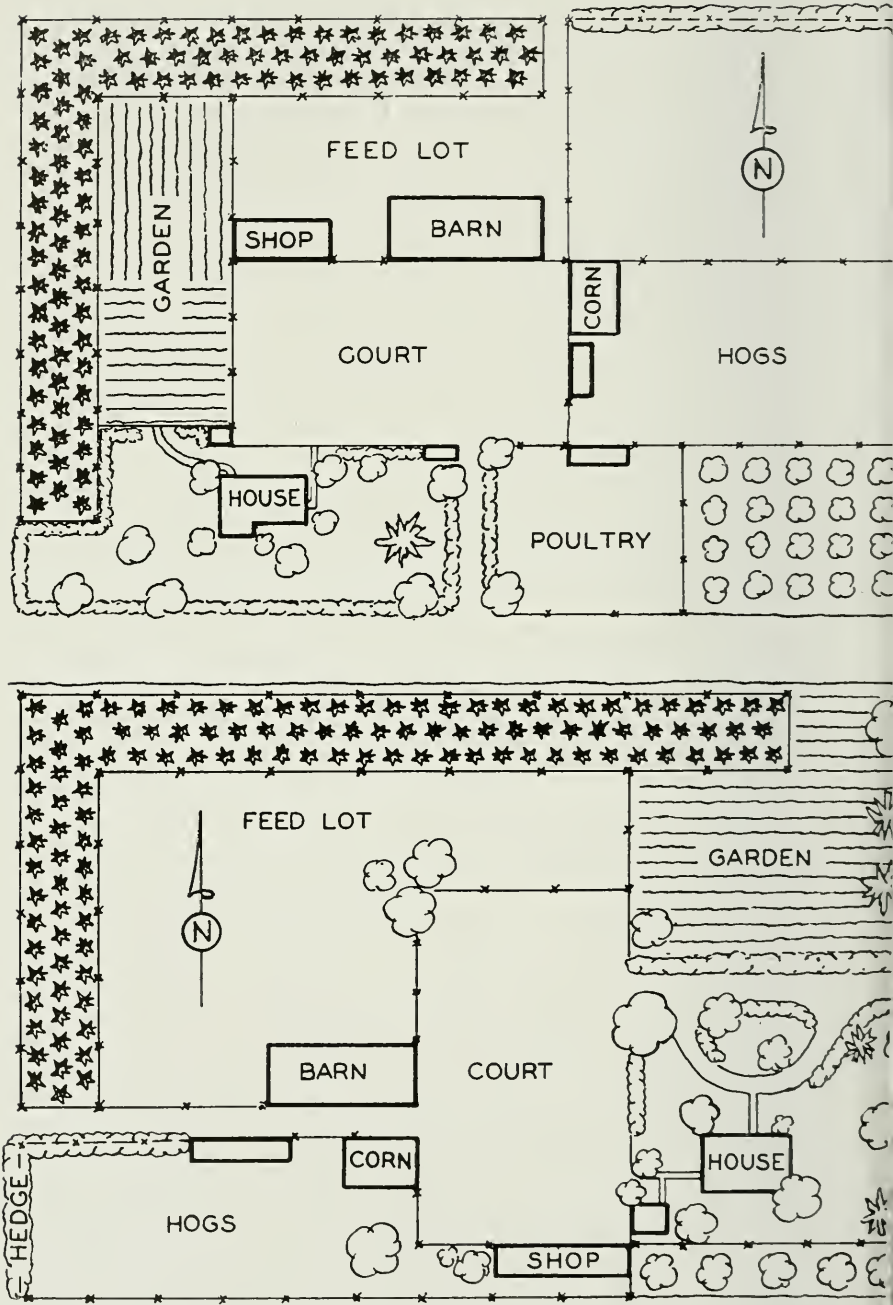


Fig. 5.—Plan for windbreak for farmsteads facing (above) south; (below) east.

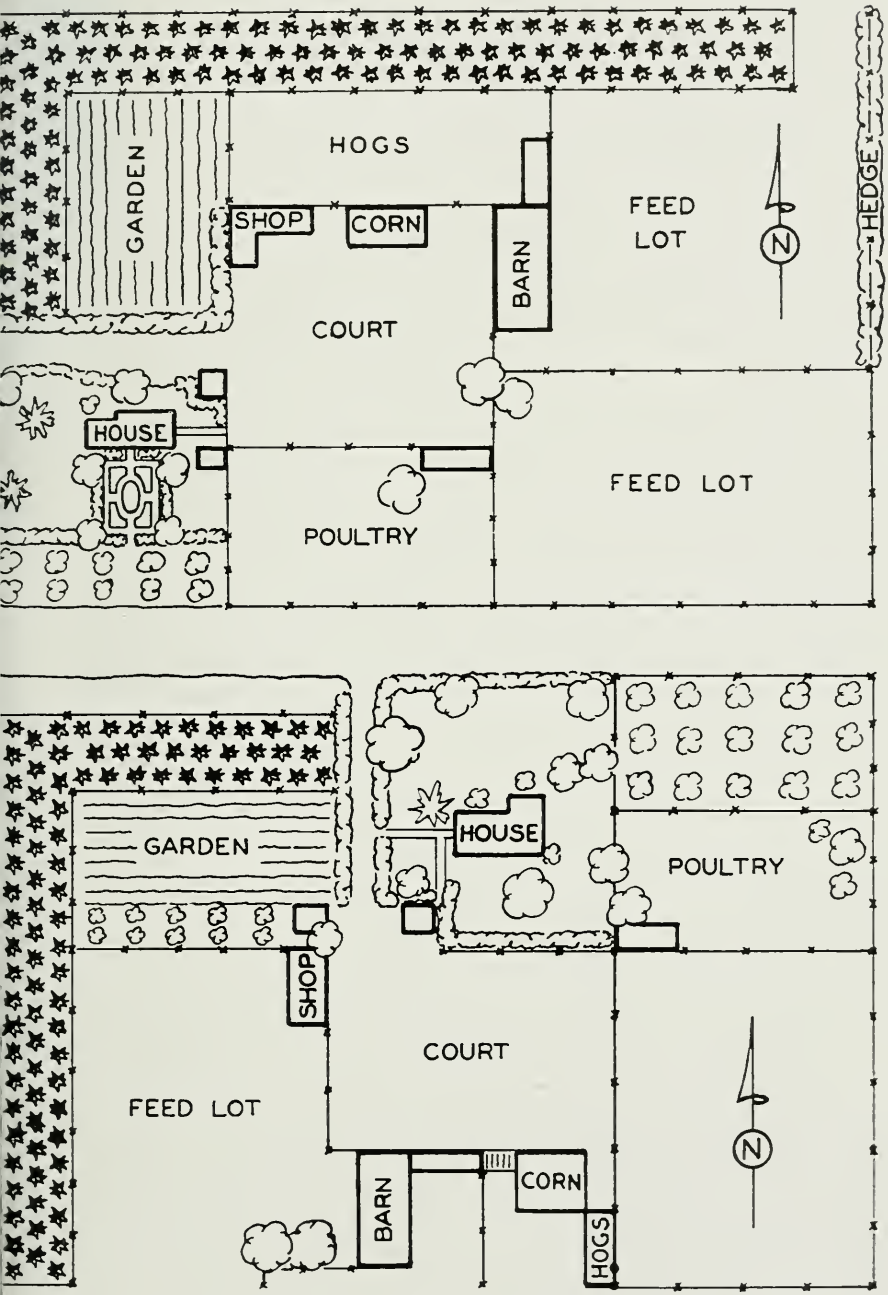


Fig. 6.—Plan for windbreak for farmsteads facing (above) west; (below) north.

in good condition. The earlier in the spring the better. After receiving notice of the shipping of your trees call your express office daily so that you can get the trees as quickly as possible after their arrival. Trees of the size you will get are not balled with earth, but are usually tied in bunches and packed tightly

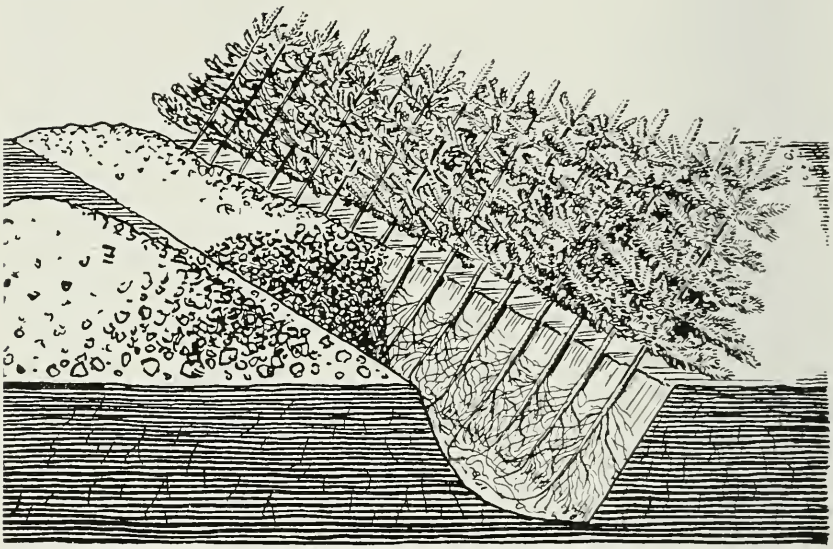


Fig. 7.—Method of heeling in trees.

in crates or burlap bundles with the roots in moist moss. The moss is necessary to keep the tree roots moist, but if left very long it will heat and may seriously damage the trees.

The trees should not only be taken from the express office as soon as they arrive, but when taken to the farm they should be immediately unpacked and heeled in. By heeling in is meant the placing of the trees upright in a trench and the packing of soil firmly around the roots to keep them moist, fig. 7. Make a trench 10 to 12 inches deep and long enough to contain the trees placed side by side in a single row. One side of the trench should be straight and slightly sloping, and the soil that is removed should be piled on the other side so it can be easily thrown over the roots after trees are placed in the trench. Before opening each bunch of trees it will be well to cut off any long, straggling roots, as such root ends curled up in the bottom of the planting hole or turned back toward the top cannot grow properly. After pruning the straggling roots, open the bundles

and spread the trees along the straight side of the trench; replace the soil and pack it about the roots of the trees.

Do not take the bundles of trees from the moist moss until the trench is prepared. *Care must be taken at all times to keep the roots of the trees moist.* Drying of the roots will kill them, and it is improper handling of the trees that causes many serious plantation losses. After heeling in the trees, water the soil about the roots and keep it well watered until all trees are planted. The trees should be heeled in in a shady place, or should be shaded with boards or burlap set high enough off the ground to allow free circulation of air around the trees. The trees may be kept heeled in a week or 10 days, but best results can be expected if they are planted in the windbreak at once.

When being planted, the trees should be carried in a galvanized bucket containing about two quarts of water. The water will serve to keep the roots moist while being carried along the rows. Trees should be taken from the bucket one at a time, and a tree should not be removed until the hole for it is prepared. These little trees should never be carried around in the planter's hand, for a few seconds of exposure will kill the fine roots.

Planting.—The mattock, or grub-hoe, is the most convenient tool to use for planting windbreak trees. A shovel or a spade may also be used, since the soil will be well worked up and easily handled.

The hole in which the tree is planted should be deep enough and wide enough to accommodate the roots well spread out in a natural position, and to allow the tree to be set at least as deep as it grew in the nursery. Planting the tree up to a half inch deeper than it grew in the nursery will do no harm, but it should never be planted any shallower. In planting hold the tree in an upright position and work the soil down in around the roots. When the hole is filled, firm the soil with the feet and place a little loose soil over the surface to check rapid drying.

When planting windbreak trees, watch out for these "don'ts": Don't allow tree roots to become dried in handling. Don't make the hole so shallow that the roots will have to be curled up or bunched. Don't set the tree in a leaning position. Don't set the tree more than a half inch deeper than it grew in the nursery, and never any shallower. Don't put dry soil, sod or other debris in the bottom of the hole. Don't leave loose soil around the roots of the trees.

If the soil is dry, watering the trees immediately after planting will give them a better chance to survive. Water the

soil thoroughly after packing it about the roots, and then place some loose soil over the surface as a mulch.

CARE OF THE WINDBREAK

Protection.—Windbreaks, to be successful, must be protected from both stock and poultry throughout their entire lives. To this end adequate fences should be built, *even before the trees are planted.*

Animals pack the soil and injure tree roots; they browse and trample the trees when small, and spoil the effectiveness of larger trees by browsing the foliage and by breaking the lower branches. Poultry scratch out the roots, pick the opening buds in the spring, and when they roost in trees their droppings will kill the branches. In some situations protection from rabbits may also be necessary, but this is usually taken care of if the fence is poultry-tight.

Cultivation.—Cultivation of the windbreak for at least the first five years is essential. With the newly planted trees small in size and with the rows 12 feet apart there is plenty of room to plant a garden along with the windbreak, thereby making more complete use of the land and assuring the trees of regular cultivation. Any row crops are satisfactory, but vining crops should be avoided. Where sweet corn or sunflowers are planted between the trees, the stalks may be left standing over winter to catch the snow. In cultivating, care should be taken not to work directly around the trees, to avoid injuring the roots. Remove weeds close to the trees by shallow hoeing.

Mulching.—In early fall a winter mulch of old straw (never use manure or bedding straw) should be placed around the trees to prevent frost heaving during the winter. Do not place the straw actually against the trees, for this may invite mouse injury. It should cover an area around the base of the tree at least 2 feet in diameter. This mulch may be left to decay during the summer, and replenished the next fall. Mulching should be kept up until the lower branches of the trees cover the area normally covered by the mulch.

Where interplanting of crops is not used, and straw will not interfere with cultivation, the use of a summer mulch is advantageous. Old straw should be used as described above, but it should be applied immediately after the trees are planted. It will help the trees a great deal during the first year to use

both the summer mulch and cultivation of interplanted crops, but some farmers object to the straw as interfering with the handling of the garden crop.

Replanting.—The success of a windbreak depends on a solid stand of trees being brought through to maturity. Each tree missing from the original pattern cuts down the efficiency of the windbreak, and lessens the tree planter's reward for his

Fig. 8.—The fence is an important part of the windbreak. This Norway spruce windbreak in McLean County has been protected from stock and poultry, and in 18 years has reached a height of 20 feet.

efforts in planting and caring for the trees. One cannot expect every tree to live, and there are usually a few losses during the first few years. This is why you have been advised to order at least 10 more trees than you will actually need to plant the windbreak. Set these trees about 3 feet apart in a row in the garden, and care for them as you do the windbreak. From here use them to replace trees which die out in the windbreak. There should be no further losses in the windbreak after five years, and any remaining replacement trees may be used for ornamental planting about the grounds.

Renewing Old Windbreaks.—Evergreen trees, like other living plants, will not live forever, and the time must be expected when the trees in the windbreak will start dying out. Then the windbreak will begin to lose its effectiveness. Many of the old windbreaks planted in northern Illinois in the 1860's and '70's have served well for many decades but are now becoming thin and ineffective as is shown clearly in fig. 10. The life span of the evergreens is usually longer in northern Illinois than in the southern or central parts of the state, and on the grand prairie their life span is shortest. The windbreaks planted

today, however, should last much longer than the old windbreaks have lasted since in the early plantings the trees were invariably set too close together and their greatest loss has been due to overcrowding.

As soon as an old windbreak starts thinning out, steps should be taken to get new trees established so that these new trees will be tall enough to be effective by the time the old trees have to be removed. The best plan is to start two new rows of trees outside of the old windbreak as was done in the case shown in fig. 9. When the old trees finally have to be cut, a third row of new trees may then be set where the old windbreak originally stood. If it is desired to work the windbreak in closer to the farmstead, the first two rows of new trees can be set to the inside of the old windbreak rather than to the outside. Never plant new trees among the old ones, for the evergreens need full light for their development and would be quickly killed by the shade from the old trees.

Diseases and Insects.—The trees in the windbreak should be watched for symptoms of injury by disease or insects, for such injury may seriously retard the growth of the trees, or even kill out some of them. At present there are no pests which

Fig. 9.—Two new rows of Norway spruce planted to supplement an old windbreak that is thinning out.

Fig. 10.—A Norway spruce windbreak, 65 years old and beginning to thin out, badly in need of supplemental planting.

have become serious in Illinois on the trees recommended for windbreak planting, with the exception of the tip moth which attacks shortleaf pine and pitch pine. The spread of this pest is being rapidly controlled.

It is advisable to look over the trees occasionally and whenever any symptoms of disease or insect injury appear immediately send specimens of the injured branches to the Extension Forester, at Urbana, for identification and recommendations for control measures. Quick action may save considerable loss.

Expectations.—Some persons feel that evergreens make slow growth, and that they would rather plant trees which make a showing more quickly. In truth, the trees which are considered fast growing are weak, subject to ice and wind damage, and do not make at all satisfactory windbreaks. After all, trees adapted to this climate are all comparatively slow growing, and there is a tendency among those not well acquainted with trees to expect too much of them.

Patience in caring for an evergreen windbreak will be well rewarded, for its protective influence will last several generations. Evergreen windbreaks planted in northern Illinois 65 years ago now stand 60 to 70 feet high, and have been affording good protection for more than 45 years. A Norway spruce windbreak planted 18 years ago in the southeast corner of Hamilton County has reached a height of 30 feet. Its branches form an almost impenetrable barrier to the wind. Another Norway spruce windbreak planted 12 years ago near Greenville in Bond County averages 18 feet in height. Any of the windbreak trees may be expected to make an average growth of one foot per year throughout their lives. During the first 20 years some trees may grow as much as three feet in one year, variations in growth depending on seasons and soil and moisture

conditions. On the grand prairie, none of the evergreens need be expected to make as good height growth nor to maintain as dense foliage as they do in other sections of the state.

WHAT THE WINDBREAK TREES ARE LIKE

Norway Spruce (*Picea excelsa*).—A native of Europe which has been found well adapted to planting in America. Makes good growth throughout most of the state of Illinois, but will not develop on sandy or excessively dry soils. Develops a tall conical crown with the branches tending to sweep downward and then turn slightly upward at the ends. The twigs often hang down like streamers from the lower branches. The leaves are short, needlelike and rich dark green. Grows best on deep, fresh soils.

Douglas Fir (*Pseudotsuga taxifolia*).—A native of western North America found growing under a wide variety of conditions. The type found growing in the dry central Rocky Mountain region is well adapted to planting in Illinois conditions. Develops a dense pyramidal crown, with lower branches sweeping downward similar to the Norway spruce. The densely leaved twigs, also, sweep downward from the branches, giving an exceptionally attractive appearance to the tree. The leaves are needlelike, averaging 1 inch in length, and although normally dark green may often have a blue tinge.

Fig. 11.—Interior of Norway spruce windbreak, showing density of foliage. This windbreak in southern Hamilton County has averaged 30 feet height growth in 12 years, and shows the adaptability of Norway spruce to southern Illinois.

Black Hills Spruce (*Picea glauca albertiana*).—A variety of the white spruce of the north woods native to the Black Hills region of South Dakota. Having developed under extremely dry conditions it should be one of the best trees to withstand drouth and intense heat of Illinois summers, although it has never been planted to any extent in this state. In Iowa it is highly rated as a windbreak

tree and because of its longevity and ability to withstand drouth, it is recommended over Norway spruce.[1] It develops a pyramidal crown, with branches growing straight outward. The needlelike leaves have a bluish cast which gives this tree high ornamental value.

Fig. 12.—Red cedar and Norway spruce combined in a windbreak. The two kinds of trees are the same age, but the Norway spruce in the background is twice as tall as the red cedar in front.

Norway Pine or Red Pine (*Pinus resinosa*).—A native tree of the forests of the Great Lakes region and northeastern United States which is doing exceptionally well in plantations in Illinois, even on dry, sandy soils. Makes rapid growth and attains good height. The reddish color of the bark and the sturdy upright form of this tree add to the beauty of an evergreen planting. The needlelike leaves are long, but being borne in clusters of two leaves each do not make as dense foliage as spruce or fir. This, as well as the other pines, may be planted as the center row of a spruce or fir windbreak, but should not be used alone except in the sand regions where conditions are too dry for spruce or fir. The Norway pine is particularly free from insect pests and diseases.

White Pine (*Pinus strobus*).—A native tree of northern Illinois commonly found as a dooryard tree throughout the state. Well adapted to a wide variety of soils, but will not stand dry conditions so well as Norway pine or pitch pine. This tree makes comparatively fast growth and reaches greater height than the other evergreens, except on the grand prairie where the top tends to flatten out. The dark green, needlelike leaves, borne five in a cluster, are fine and limber and form a denser foliage than that of the other pines.

Shortleaf Pine (*Pinus echinata*).—A native pine of southern Illinois found on the dry ridges of the Ozarks. Grows very rapidly and is well adapted to planting in poor, dry soils.

[1] Ramsey, G. R. 1936. Evergreen Windbreaks for Iowa Farmsteads. Iowa State College Extension Circular 217. 31 pp., 31 figs. Mar.

The needlelike leaves, borne two or three in a cluster, do not make a dense foliage. This tree is useful principally because of its rapid growth, but should be planted only in the southern part of the state.

Pitch Pine (*Pinus rigida*).—A pine native to the middle Atlantic states, found on dry mountain ridges and sandy soils. In plantations in Illinois it has made rapid growth. The stiff, needlelike leaves are borne three in a cluster and in older trees make a sparse, open foliage. Both the pitch pine and shortleaf pine may be subject to serious attacks of the pine tip moth which kills the terminal buds and checks the height growth of the trees.

Red Cedar (*Juniperus virginiana*).—A native evergreen of Illinois with short, needlelike and scalelike leaves and a very dense branching habit. It does not make great height growth, seldom reaching a height of 40 feet, but is adapted to practically all soils. Because of its dense crown it is useful where there is room for only a single row of trees. The red cedar harbors the cedar apple rust, which may cause serious damage to its alternate host, the apple. It is therefore not recommended for use in apple regions, although orchardists may grow rust-resistant varieties of apples.

OTHER TREE PUBLICATIONS

Care of Trees.—Sawyer, L. E., Illinois State Natural History Survey Forestry Circular No. 5, 1932.

Forest Planting on Illinois Farms—Davis, J. E., University of Illinois College of Agriculture and Agricultural Experiment Station Circular No. 477, 1937.

Managing the Farm Woods for Profit.—Sawyer, L. E., University of Illinois College of Agriculture and Agricultural Experiment Station Circular No. 392. 1932.

Marketing Illinois Forest Products—Sawyer, L. E., University of Illinois College of Agriculture and Agricultural Experiment Station Circular No. 361. 1930.

Elements of Forestry with Special Reference to Illinois—Locke, Stanley S., State of Illinois Division of Forestry, Department of Conservation, Publication No. 9, 1936.

Mimeographed leaflets of the Illinois State Natural History Survey and University of Illinois College of Agriculture: Shade Tree Feeding, L. R. Tehon; Killing Undesirable Trees with Poison, J. E. Davis; Treating Fence Posts on the Farm, J. E. Davis.

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